BOOK 1R

Notes
Blank pages:
inside first sheet, 1,2,4,6,8,10,12,31,32,47-265, 270-279, 282-300.

Scanned by:
Sheila Finch
RSICC /Oak Ridge National Lab.
March 19, 1999

Book 1

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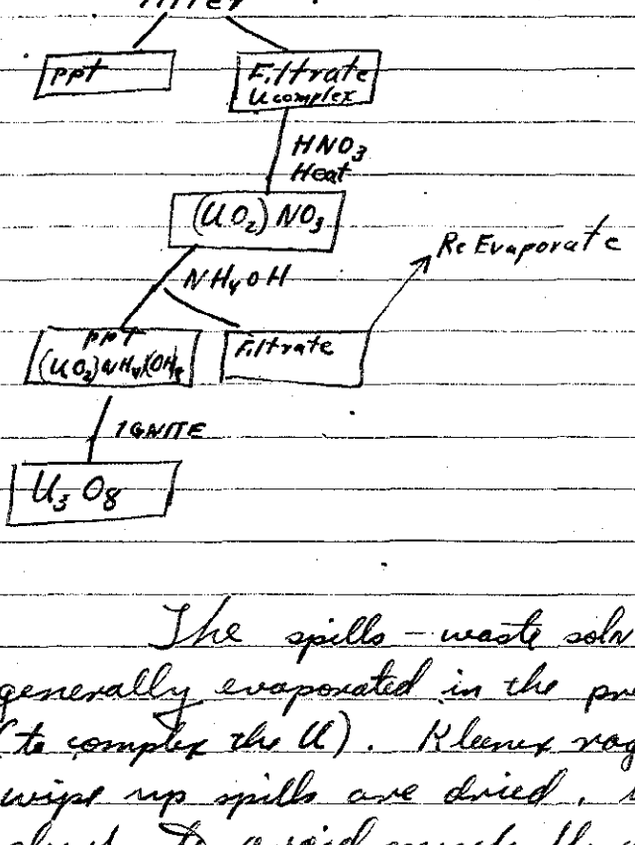
Tabulation of N_H/N_X vs Sp. Gr.

N_H/N_X	Sp. Gr.	% X.
24.15	2.02	46.12
22.67	2.10	
20.75	2.13	46 % 4
31.0	1.90	41.45
31.42	1.88	
33.40	1.85	
38.10	1.73	
41.45	1.667	34.86
43.87		
46.2	1.59	
61.2	1.47	26.76
62.6	1.501	26.39
86.3	1.353	22.79
89.23	1.3478	20.79 =
120.19	1.293	18.19
127.45	1.250	15.94
132.93	1.2370	15.42
159.57	1.199	13.32
216.22	1.150	10.33
319.84	1.103	7.32

Recovery Process



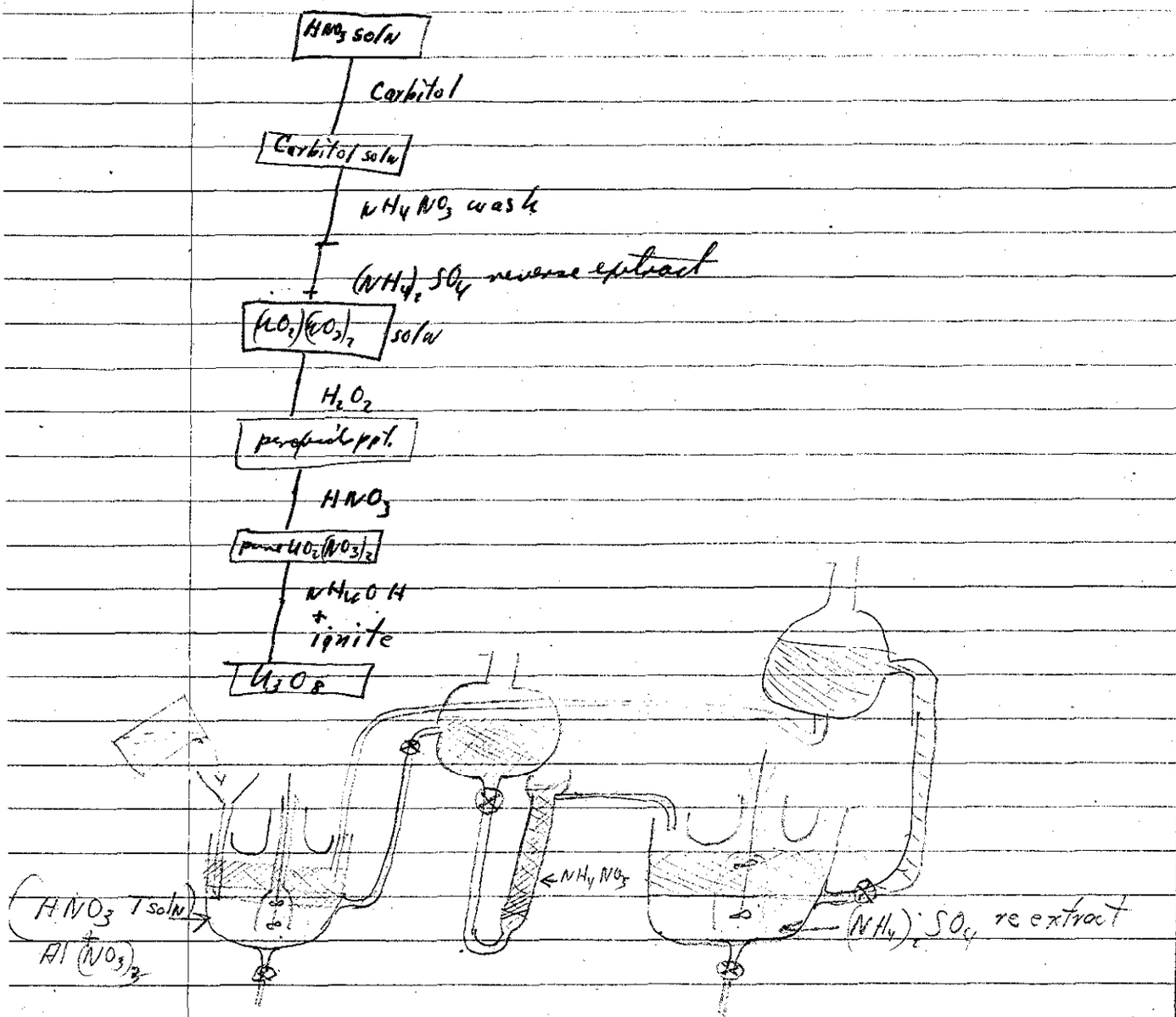
Uranium preparation
Some details on equipment preparation

The spills - waste soln - if liquid are generally evaporated in the presence of excess Na_2CO_3 (to complex the U). Kleenex rags etc used to wipe up spills are dried, burned in a hood, slowly to avoid much flyash, the carbonized material then ignited at about 1200° in a Vycor dish to remove all carbon.

This ash then treated with HNO_3 (1-1) the insoluble residue filtered off and the material carried then the scheme as shown above.

Extraction

Same as previous except that after filtering the insoluble residue from the HNO_3 soln the soln is evap down to a density of about 1.62 and $Al(NO_3)_3$ added and the soln adjusted to a density of 1.62 when it is added to the extraction apparatus



1/28/48

Using apparatus on page 7 - Recovered material by following method:

Rags - sponges - Kleenex, paper towels and other combustible material that were used to wipe up spills etc.... were ashed, and the ash ignited - then dissolved in HNO_3

Carbonate and nitric acid solution used for decontamination were combined and evaporated to concentrate the uranium.

As various salts separated out, the mother liquor was poured off, concentrating sometimes as much as 16:1.

Proposed to take this evaporated material running about 20-30% U, adjust the pH to 2-3, saturate with aluminum nitrate (salting out agent) and extract with an equal volume of Carbitol.

Probably six extractions would be necessary. Using NH_4SO_4 as back-wash and an NH_4OH ppt'n to recover U.

Samples for U analysis taken on the original material, on the back extraction. On the carbitol after the final extraction.

The samples should be extracted for 15 min and then allowed to settle

1/28/48

Sample liquid before extract. 13.4134 Sp. Gr. 1.48
dish #27 8.7349 sub with $0.1 M (NO_3)_3$
4.6785 pH = < 2
wgt oxides + dish 9.7142
wgt U = 0.1841 = 4.16% U

Sample after 1st Extract 15.6390
dish #28 8.5068 sp Gr. 1.42
wgt oxide + dish 7.1327
9.9871
8.5068
1.4803 gm oxide dis. = 2.64%

Sample from 1st $(NH_4)_2SO_4$ extract.
dish #1 14.0486
6.8463
7.2023 gms
wgt oxide + dish 6.9798
6.8463
.1335 gms oxide

Sample from final raffinate after 6 passes
#38 13.2700
8.2235
wgt soln 5.0465
wgt U = .0397
% U = 0.79%

1.52
2.64
3.37
.79

2/12/48

From results above:
One extraction from a solution containing 4.16% U lowered it to 2.64% U a loss of 1.52% or 36.5% of material removed by a single extraction; a final sample taken contained 0.79% U or a total removal of 88.9% removal in 6 passes. If the density was regulated to 1.62 and the pH adjusted more carefully — possibly better recovery would result.

7/5/48. Entire Bldg decontaminated, by ~~Cascade~~ Cascade service — leaving approx 50 gal of solution — as Na_2CO_3 + Terpital including some chlorides all HCl wash having been neutralized with Na_2CO_3.

α/min now down to 500 on all surfaces with zero wipe test except for: the interior of the storage pit, outside of storage cylinders, the reactors, dump pan, and directly beneath dump pan. The pan cover has been decontaminated as has been the outside of the tamper tanks.

One or two rough drafts of procedures used in handling material drawn — all based on use of ordinary analytical technique.

Laboratory:

All benches decontaminated including hoods + hot plates. Hood #1 contains evap setup for concentrating prior to storage, #3 has small muffle furnace and hot plate to be used primarily for ignition of precipitates.

Hood #2 thoroughly cleaned, a stainless ~~steel~~ ~~steel~~ steel manifold using Hoke valves for the vacuum filtration system — Removable plywood panels installed to make air + fume removal more efficient.

Vacuum traps designed to prevent contamination of pumps.

A burner (enclosed) designed and built for burning combustible material to be placed on remaining desk area adjacent to Hood #2 — Also in this area proposed to install Conlon distillation apparatus.

On opposite side of desk will be ~~a~~ batch and continuous extraction.

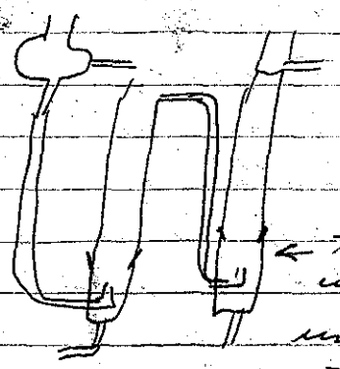
3/6 Exposed desk surfaces to be painted with at least 1 coat of Pmy coat (clear) and working surfaces of hoods. This to fill up pores of transite top and make it easier to keep down contamination.

Following surfaces painted: on desk #2 including area under Hood #2

3/7/48 All exposed surfaces painted (transite) except for a small area near hood #4 which is now covered with Kraft paper —

The active solution H/X u 200 has been filtered thru glass wool plugs.

The long extraction columns set up, leak tested and flow rates checked using water & carbitol. drop size at jet is about 1 mm.



← this section should be cut off and re welded until overall length is not more than 6" (present length 12")

Flow rate = 21.4 ml/min of carbitol (clean)

time of bubble travel thru column (contact time 13 sec (both columns)

Volume of carbitol to be used is about 2 liters.

The distribution coefficient expected is approx 300 in favor of $\frac{org}{aqueous}$ — using $(NH_4)_2SO_4$ bicarbonate

$\frac{aq}{org}$ = ? not yet determined.

The K for $\frac{org}{aqu}$ using $Al(NO_3)_3$ as salting out agent from batch process seems to run about 60, with one 15 min pass in batch extractor equiv to 0.45 Theoretical Stages

5/13/46 1st charge to Extractor = 1.8 Mg/gm
Raffinate = 0.3 Mg/gm

Samples taken of material (50 ml/sample)

Feed Material

F-2	.006 gms/gm
F-3	.0092 gm/gm
F-4	.0115
F-5	.0145
F-6	.0088
F-7	.0066
F-8	.0046
F-9	.0121

Raffinate

S-2	.0053 gm/gm
S-3	.0023

If density of Fed exceeds 1.35 crystals of $Cu(NO_3)_2$(?) form in small orifice.

5/18/48 Removed spidles sampled and sealed in bottles for transfer

#2 - 0.9950 gm sample 480.959 gms Ox

#3 = 1.0170 gm sample 384.404 gms Ox

5/19/48 Calibration:

Charge = $\frac{140.03}{129.99}$ } .004 gm/gm
10.04 gms/2000 ml }

Approx @ 600 gms of $Cu(NO_3)_2$ added

Sp. Gr. = 1.250 1st portion extruded from 9:55 AM 1:30 P.M.

5/21/48 Calibration

Start = 10 gms / 2 liters

opids at end of 3½ hrs = 5.7800 gms

4.22 gms / 2 liters remain

at end of 2nd 3 hrs = 2.4148 gms

1.5862 gms / 2 liters.

~~4??~~ 8.1948 gms opids

total in 6½ hr = ~~[illegible]~~

~~[illegible]~~ /

approx 82% recovery if original opids ≟ 10 gms – however orig opid was rather impure actually about 9 effective gms.

Total at end of 10½ hrs = 9.5785 gms

in Raffinate = 0.13 gm / liter

= 0.26 gm not recovered

9.5785 / 9.8385 = 97.36% recovered.

S-4 = 3.76 gm / liter

S-5 = 1.05 " "

F-10 = 8.36 " "

6/17/68 Sampled:

S-7	100cc	Sp Gr. 1.24
S-6	"	" 1.29
S-8	"	" 1.25
S-9	"	" 1.18

Note S-8 + S-9 after 6-8 hrs in extractor were batch extracted before storing.

S-5 1.05 gm/liter (4 liters) sp Gr. 1.24 sent to Coled Chemical.

S-1 .0003 gm/gm 2 liters sp Gr. 1.25 also sent.

July 2 Inventory of Material in Recovery:

Oxide recovered + sent to Coded/Chemicals — 394.40

315.796
384.345
353.563

460.68
278.55

Total Oxide 1233.63

1053.704 Grams U. ~~999.9~~

Other material sent to Coded Chemical:

18/5 gallons of soda ash sol'n 113.50 liters
123.60 liters
total 237.10 liters

gms U/liter =
Total U =

Raffinate from extraction
S-1 2,500 gms
3.52 gms U
S-5 4,960 gms
5.76 gms U
9.28 gms U

Contaminated salts (1 can) 51.50 pounds

net U = .0003 gm/gm

As laboratory Samples.

Req. No.	Samples	as	gms U	gms X
710002	167	UO_2F_2 sol	1.3930	
710003	S-6	Raffinate	0.1116	
710004	S-7	"	0.3213	
710005	S-8	"	0.2232	
710006	S-9	"	0.2280	
710007	171	UO_2F_2 sol	2.9980	
Total			5.2751	4.9269
	F-2	Feed	0.4050	
	F-3		0.5700	
	F-4		0.7580	
	F-5		0.9210	
	F-6		0.5980	
	F-7		0.4520	
	F-8		0.3170	
	F-9		0.8410	
	F-10		0.41800	
	C-1		0.0065	
	S-2		0.337	
	S-3		0.147	
	S-4		0.1880	
	S-5		0.05250	
	156	UO_2F_2 sol	1.8356	
	~~#~~ 157-8	"	1.8356	
			9.6832 gms	

Samples checked were on May inventory

Total sent to lab 14.9583 gms
Total Recovered + sent 1053.704
1068.6623
Raffinate sent 9.28
1077.9423 gms U = 1006.798 gms X

7/2 Material in recovery

		Vol	Kg	gm U
Feed -	F-2	4 Liters	5.400	32.40
	F3	"	4.96	45.63
	F4	"	5.28	60.72
	F5	"	5.08	73.66
	F6	"	5.44	47.87
	F-7	"	5.48	36.17
	F-8	"	5.52	25.39
	~~F-10~~			321.84
	F-12	1 Liter	1.25	

Raffinate	Vol	Kg	gm U 26.9
S-2	4 Liters	~~5.06~~ 5.08	~~4.864~~ ~~2.868~~
S-3		~~5.06~~ 5.12	~~12.852~~ 11.7
S-6		4.96	4.864
S-7		4.76	12.852
S-8		4.96	8.928
S-9		4.56	9.120
			74.064

Total Gms U in storage 395.904

Also:
1 Liter of feed material (F-12)
2 Gal of Raffinate not sampled
2 gal used Control

Est 60 gm of oxide = 48.63 gms U

total gms = 444.534 U

Also approx 15.04 gm U in Filtrate

459.574

In pit as measured = 12.094 liters
10.70 Kg U
Oxide Shipped to Coded Chem 1.054 Kg
To lab as samples .015
as Raffinate .009
accounted for = 11.778 Kg U
Known in Recovery Process .460
12.238 Kg U

Note: this does not include the 18/5 gal cans of soda ash sol'n from decontamination nor contaminated salt (52 lbs.) nor material in Kleenex burner.

From Inventory 6-2-48
net wt U = 13,181.45 gms
net wt X = 12,311.41

Therefore in losses (on floors or in recovery)
last Inventory 13,181.45
calculated → 12.238
943.45 gms U
Unaccounted for → 881.18 gms X

Estimated that (on holdup in cylinders in pit
3 cylinders 4/X 26 = 215 g U
6 " 4/X 1000 = 013 g U
228 gms U

losses 943.45
228
715.45 gms U unaccounted for

except: on contaminated surfaces (floor, Kleenex, piping, etc.)
in burner
in contaminated solutions in laboratory

From Ex 174 = 6½" cyl

area = 214.08

× 41.6

8.906 liters @ Sp. Gr. 1.978

17.616 Kg

3.5 L. DV 6.923 Kg

24.539 Kg

41.78% X

10.2524 Kg X

7/7/48

709 Jesse inventory

Date and D.	Code No.	Laboratory Sample size sample	% T	wgt T
5/28	F-10	50 ml	8.36 g/L	.1418
5/27	C-1	50 ml	0.13 g/L	.007
5/28	S-4	50 ml	3.76 g/L	.188
5/28	S-5	50 ml	1.05 g/L	.053
6/17	156	124	.09%	.112
6/17	S-7	119 gm	.27%	.321
6/17	S-8	124 gm	.18%	.223
6/17	S-9	114 gm	0.20%	.228
5/27	156	52.20 gm	3.53%	1.836
	157-8	52.20 gm	3.53%	1.836
6/17	167	51.60 gm	2.70%	1.393
6/28	171	6.70	44.74	6.615
				2.998
				9.613

Send as Oxide to Coded Chem.

6-17	P-3	394.40	80.07	315.796
	P-3A	460.68	83.43	384.345
				700.141

As contaminated salts $(NH_4)_2SO_4$

6-17	4817	52.75 lbs	.0003 gm/gm	

As raffinate

6-17	S-11	2500 gm	0.75
	S-5	4960 gm 4100 cc 1.05 gm/L	4.305

Acid sol neutrd with soda Ash (decontaminated)

6-7

114.50 liters

47 ppm

.000,047

.005,381.5 gms assay 17.99% X

4304
538
.9684

0.97 gms X

~~3~~ 124.60

53 ppm

~~00~~6603.8 gms assay 26.13% X
6.6 gms .16.60
3
15678
15618
1.724.58 gms X

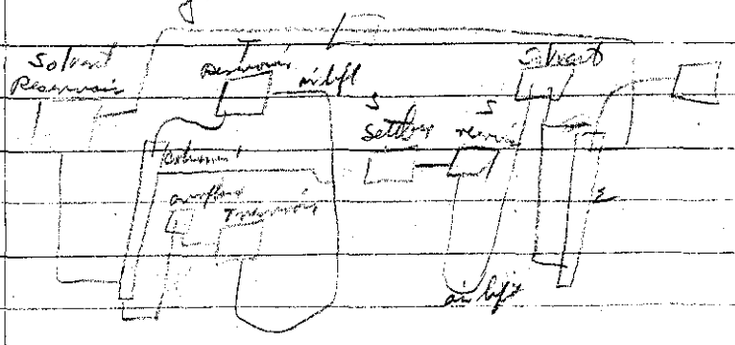
Opening Inventory
wgt T X

13,181.450 gms 12,311.41

~~Shipped 789.315~~
12,397.857 ~~14,679.598 gms~~
~~10252~~
~~4,327.198~~

9.61
710.14
71.78
.75
4.31
.97
1.73
789.29 gms Total

7/9/47 S-4 (3.76 g/l) replaced in extractor with additional $Zr(NO_3)_4$. also flow rate of stripping column increased by adding an air lift and higher reservoir



Spray heads (Cranks) made for both columns

7/29/48 Extraction columns dismantled & cleaned - recovery now to be carried out by shipping aggregates to Y-12 and upon their analysis to return purified UO_2F_2 salt in equivalent amounts.

Analysis rec'd on Exp 184 - 0.1804 gm U/gm sample

0.1804 gm U ≡ 0.2345 gm UO_2F_2

.1685 gm X

1.0000 gm sol'n

.2345 UO_2F_2

.7655 gm H_2O

$$\frac{\frac{.1804}{235}}{\frac{.7655}{9}} = \frac{\frac{.7658}{9}}{\frac{.1804}{235.15}} = \frac{.7658}{.1804} \times \frac{235.15}{9}$$

$$= 4245 \times 2612$$

$$\frac{.1804}{.7658} \times \frac{9}{238} = 90.15$$

H/X = 110.88

Syn Yx 1.262

From Exp 187

.1086 gms U = .1410 gms UO_2F_2
.1014 gm X
1.0000
.1410
.8590 gms H_2O

sp Gr. 1.144

$\frac{.8590}{.1086} \times 26.12 = 206.60$ ~~H~~ U

$\frac{8590}{1014} \times 2612 = 221.2$ U X

Recovery Solution on Hand

Label	Amount	% U	Wgt U	Sample No.	Remarks
~~F-3~~	~~5850 1218 4627 gms~~	0.92		F-3 C	
F-4	6228 1319 / 4909 gms	1.15			
F-6	6113 1228 / 4885 gms	0.88			
F-7	6275 1312 / 4963	0.66			
F-8	6352 1238 / 5114 gms	0.46			
~~S-6~~	~~5600 1700 / 3900~~				
S-7	6000 1365 / 4635	~~2.7%~~ 0.27		710004	by Wgt
S-9	5680 1288 / 4392	0.20		710006	" "
S-10	5695 1240 / 4455	0.13		~~710014~~ 710014	" "
S-11	6135 1232 / 4903	0.20		710015	" "
S-12	6300 1265 / 5035	0.04		710016	" "
S-13	6200 1270 / 4930	0.10		710017	" "
S-2	5600 1700 / 3900	0.53			
C-2	4660 1283 / 3377	0.5 ppm U		710018	
R-20	5257 1300 3957 gms				
R-21	5254 1300 3954 gms				
R-22	4058 1255 / 2803				
R-23	5600 1273 4327 gms				
R-24	5450 1260 / 4190				
R-25	5550 1263 / 4287				
R-26	3900 1300 / 2600				
R-27	3500 1280 / 2220				
R-28	5000 1240 / 3760				
R-29	5660 1228 / 4432				
R-30	5890 1300 / 4590				

See page 29

capsuled

	% U	U ppm	Sample No
F-12	5988 / 1235	4713	
S-8	6120 / 1590	4530	.18 710005
~~S-6~~			
R-31	4400 / 1250	3150	
R-32	6420 / 1300	5120	
R-33	6420 / 1265	5155	

Samples sent to lab during July

Req No.	Sample No.	% U	Wgt sample	Wgt U	date
71 0002	N-7	2.70	51.60	15.00	6/17
" 3	S-6	.09	124	11.16	6/17
" 4	S-7	0.27	119	32.13	6/17
" 5	S-8	0.18	124	22.32	6/17
" 6	S-9	0.20	114	22.80	6/17
" 7	171	44.74	6.70 gm	2.55	6/28
14	S-10	0.13	35.24	.04 58	6/28
15	S-11	0.20	37.27	.07 45	7-8
16	S-12	0.04	41.24	.01 65	7-8
17	S-13	0.10	39.13	.03 91	7-8
18	C-2	0.5 ppm U	26.45		7-8
19	176	30.09	27.17	8.18	7-17
20	184	18.04	13.96	2.52	7/20
21	187	10.86	12.23	1.33	7/21
Total					

→ Note these shipped in June + recorded on June Inventory

3
2.52
8.18
.09
.07
.08
.083

.05
.087 → .07
.02
.04
8.18 → 8.17
2.52
1.83
12.2 → 12.20
93.4

11.39

12,485.78
12.20
12,433.58
11,633.04
11.39
11,621.65

CRUD SAMPLES - FLOOR WASHINGS, etc. 8/11/48

R-34	130.030		R-40	140.154
	79.570			84.204
	50.460			55.950
R-35	134.367		R-41	134.385
	78.730			79.647
	55.637			54.738
R-36	136.034			
	79.230			
	56.804			
R-37	147.174			
	84.317			
	62.857			
R-38	139.923			
	84.081			
	55.842			
R-39	131.820			
	81.092			
	50.728			

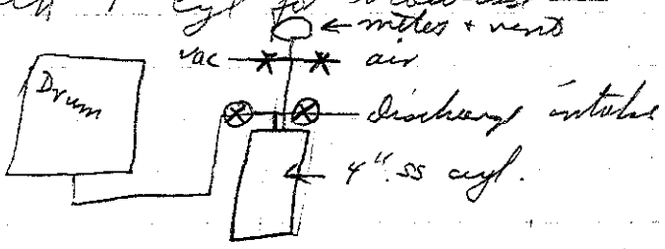
Waste + Wash Solutions

Containers No.	Gross	Tare	Net	% U ~~Wgt~~ Wgt X
R-20	5205	1300	3905	0.29
R-21	5203	1300	3903	0.05
R-22	4014	1255	2759	11ppm
R-23	~~5543~~	1273	4270	0.08
R-24	5372	1260	4132	0.73
R-25	5494	1263	4231	0.02
R-26	3844	1300	2544	0.03
R-27	3456	1280	2176	0.06
R-28	4940	1240	3700	0.06
R-29	5601	1228	4373	0.09
R-30	5835	1300	4535	0.09
R-31	4356	1250	3106	0.09
R-32	6353	1300	5053	0.42
R-33	6353	1265	5085	0.05
R-34	4916	1248	3668	0.01
R-35	5195	1278	3917	0.23
R-36	5539	1259	4280	0.08
R-37	5738	1271	4467	0.23
R-38	5274	1250	4024	0.05
R-39	3331	1259	2072	0.04
R-40	5483	1246	4237	0.01
R-41	4256	1280	2976	0.03
F-3	5845	1218	4627	0.92
F-4	6228	1319	4909	1.15
F-6	6113	1228	4885	0.88
F-7	6275	1312	4963	0.66
F-8	6352	1238	5114	0.16
C-2	4660	1283	3377	0.5ppm
S-9	5680	1288	4392	0.20
S-10	5695	12540	4455	0.13
S-8	6120	1590	4530	0.18
F-12	5988	1275	4713	
S-13	6200	1270	4930	0.10
S-2	5600	1700	3900	0.53
S-11	6135	1232	4903	0.20
S-12	6300	1265	5035	0.04
S-7	6000	1365	4635	0.11

30
10/13/48

Sample	Gross	Tare	Net	%U	WgtU
R-34	5280	1300	3980		
R-35	5923	1275	4648		
R-36	5270	1577	3693		
R-37	995.149	420.152	574.097		
R-38	3744	1290	2454		
R-39	5300	1235	4055		
R-40	5507	1559	3948		

Aug 22 '49
Monday. Weinberg lecture Fox Cadillon + Cronin 8-9
Cadillon 9-12 new Bldg Mr. Clare
Fox + Cronin piping to 54 gal drums finished
leak testing (hydrostatic)
told CT-I to test all cans by static water
54 gal drums won't stand enough pressure
or vacuum to empty or fill rapidly
Small Eastern Centrifugal pumps has
leaky packing - as used acid egg
with 4" cyl for blowers —



With ¼" P-10 line & ¼" needle valve
4" cyl (7 liters) fill in 5 min with 25 in of Hg
empty in 1 min 8 lb air
removed needle valve + time to fill
is 2 min.
Exper. 253 in afternoon quit at 4:30
DH

Aug 23

Lecture 8-9 DHC (JKF) (ADC)
Dr. Callihan to McClure in AM
Fox + Cronin - prep for Exp. 1 hr.
2 hrs on ~~new~~ layout + form for lab.
adjust Boron lined counters to count only with neutron -

with voltage at counters (as measured by Volt Ohmyst at 455 volts)

	Neutron source alone	Gamma source neutron source
#1	43 1/2	44
	44	44
#2	53	55

holding gamma source next to counter tube did not increase count level even at background

Aug 24

Fox Morfitt set up Exp in AM
Callihan & Brown at Mr. Levin concerning
sampling size of samples and precision
of analyses.

Exp.
Staff met & discussed new bldg –
Dr. Cal. described Schenectady plant and
suggested modifications for us
John Morfitt to Y-12 for looks at
Counting set up.

While draining bols under vacuum
some sol'n 'ran into air manifold
checked pop off valve & vac line in
control for alpha – none detected.

Aug 15

Thurs.

Lecture 6-9

Fox + Cronin 1st cell of F/ core dropped last shelf transported to F-05

conference at noon + after for new bldg after. Grp 257 with ½" Stainless Shell.

for Morfitt Cronin

Reactor prepared for run. with ¼" Stainless stud noticed what appeared to be an air leak in Cyl #4 in pit (D) possible wearing of valve seat.

Checked stainless as taken off for gamma - barely detectable on most sensitive scale.

Aug 26 Fri

1-hr Sect. 8-9

2 hrs Picked up 2 sets of al shells for Reactor + material from ~~Store~~

2 hrs worked on inventory and shipped material to Coded Chem.

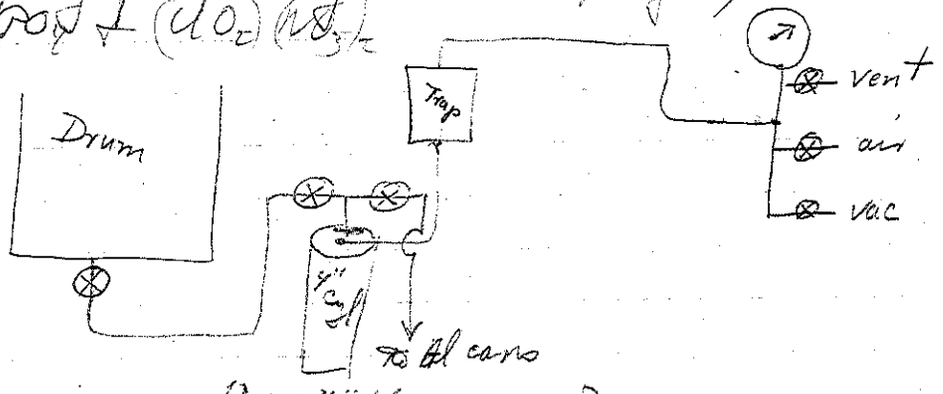
2 hrs Epp 258 1/4" Stainless steel

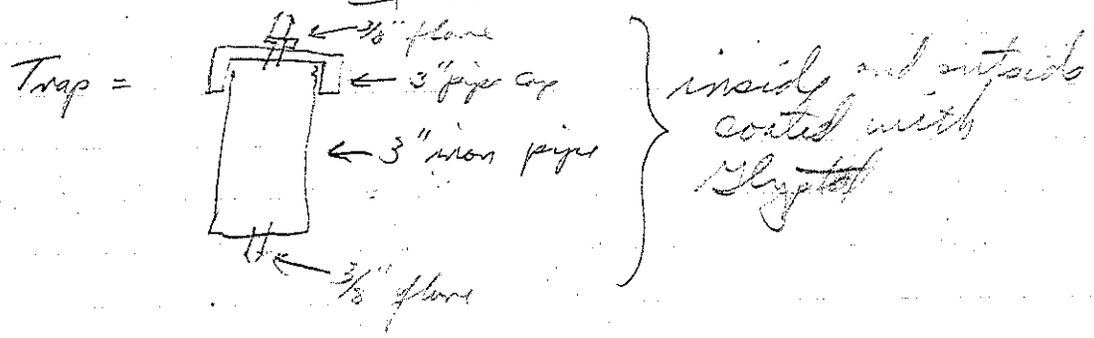
7 hr. Clean up

Aug 29 Tech. 8-9
9-12 prep for Epp. reid all of Al cans ready for use with 1 coat bakelite
Epp in PM until 5 PM

Aug 30 Tech 8-9
9-10:30 prep for Epp with Al cans with water 5" water —
Afternoon repaired Instrument with Nilse #5 needed drying out —
Reed — broken connection to ~~accelerator~~ #1 counter — microphonic 6AK5 in preamp.
Made ½ trap for H_2S system

Aug 31 Piping for filling and emptying 55 gal drums of H_2SO_4 + (CO_2) (N_2)





Sept 1 — lecture 8-9
Prep. of cylinders for inventory
removing paper wrappings + sampling
Cyl C (had dead vol.) and Cyl E (all working)

Friday Sept 2 — Replaced cylinders in pit. and finished leak testing acid transfer system.
Bought larger fluorothene rod for valves packings. using fluorothene tubing for lines.

Sept 6 — Leaks evident around Reactor —
See p-63-64-65 etc in book #22 (10147)
Cleaned up some (~~—~~ survey instrument to be replaced.)

Sept 12 — Surveyed and had C.S. Man re-clean Stainless steel plates & Aluminum shells. Re-surveyed-clean
Cut end of 9" aluminum reactor.
Cut gasket for cover of water tank
Dr C spent day with Greuling, Henry etc

9/13 — Fox decontaminated 5' pipe section of 3" pipe —
New gaskets for tamper tank -

DC with Greuling - Moffitt on F05 work
8" SS reactor at weld shop

9/14 — DC - new bldg + inventory - Strong + Fortune here to see spill -
8" SS reactor welded; to S + I.
Moffitt + Fox installed 10" reactor + Al ~~shells~~ shells for continuation of effect of H_2O tamper thickness
Cleanout 55 gal storage tanks for H_3PO_4 and $UO_2(NO_3)_2$ normal

9/15 - 9-16
Experimental work on 10" Al with various amounts of tamping using Al shells.

9-19- Clean up - replaced source connection by a cable loop of S. Steel wire
8" SS reactor repaired.
Filled 1 Al shell with H_3PO_4 - paint coating evidently not continuous - hydrogen evolution - All shells sent to Paint shop for re-painting.
Dick Maddin here all day - removed PM assy - amp. bad.

9-20 Rec'd normal rehydrated 103 kg & attempt to dissolve in 5½ gal drum. appears to have considerable carbon suspended Mr. Krucsi from Hanford.
8" Al returned from decontamination still hot.
Dick here today -

9/23 - 24 Weighed a disc of 3-S Al & placed in H_3PO_4 for 36 hrs -

Orig wgt	= 64.773 gm
after	= 60.762
wgt loss	4.011

Diam. = 2 3/64"
thickness = 0.284"
= 0.2 mm penetration in 36 hrs on bare uncoated disc.

9/26/ H_3PO_4 put into Al. shells — still quite a reaction after setting overnight. doesn't seem to be too much penetration however.

9/27 $(UO_2)(NO_3)_2$ placed in shell for overnight testing no apparent reaction —

9/28 shells all filled + allowed to stand for 28 hrs — no apparent reaction.

9/29 Outer shell for normal U punctured by accident — shell rinsed but not decontaminated inside.

9/30/ Completion of Experiment series — Cleanup.

10/3/ Cylinders weighed and samples taken for inventory. Also from Normal material, and H_3PO_4.

Broken flouethene tubing in pit replaced and valves on 4 + 5 were also replaced.

Checked for leaks.

Al shell shell sent to Decatur for cleaning.

11-21 Health Physics survey— found improvement but still hot spots.

11/22 Replaced 8" Reactor with 15" — used paper on floor — floor clean at end of day paper hot. 8" reactor showed signs of corrosion ie free silica and bare metal surface temper discoloration

12/27/48

1. Took inventory. Popwell & Palmer furnished by Coolid Chemical [redacted] & Uranium Accounting. Popwell observer only. Fortune in for brief inspection (U. Acc.) Inventory Completed as of 4:30 P.M. normal.

2. Work order started on 2" A1 shell. Blueprint in shops. Mr. Beal.

3. Radiation Survey Group. Hanby. Survey of Rm 1, 2, & Hall

12/28/48

1. Survey continued & completed by Hanby. Floor spots cleaned up as found. Floors & Potter contaminated areas scrubbed.

2. Mopped Hallway part of operational room & all laboratory except below room.

3. Set up & run eye #349

4. Washed off all shells to [redacted] decontamination (normal material)

5. Truck three safety Cans.

6. Diluted normal uranium to appropriate 1/2 gal concentration.

7. Filled [redacted] inner shells with new concentration after reinstalling shells.

8. Y-12 can handle phosphate solutions as contained as we will & make them.

9. Unofficial Y-12 uranium receipts on Cyl. N & M 1385 g U total. Duplicate assay 93.41, 93.40 93.36. U fig. not corrected for analytical bias.

10. Took Sample of normal $UO_2(NO_3)_2$ before dilution. Lab lost first Sample.

12/29/49 McLendon for Cronin 1 Exp #350 in AM—
Shut down at 10:30AM because of gas line to powerhouse. Started up at 1:00 PM—
Exp 351 – 352 in afternoon

12/30/49. 1. Prepared 5 ℔ uranium-containing liquid for shipment. Sampled all of them. Requisitions made out. Contains logged. Also prepared 3 pipes cans for shipment.

2. Sampled normal uranium nitrate soln after dilution (+ rest of exp 350-352 end.)

3. Set up + ran exp. # 353, 4, 5

4. Checked on Machine Shop Work Shells ready Tuesday

5. Samples to Laboratory.

1/3/50 Decided Schedule

1/4/50 1. Removed 10" Reactor put in 15"

2. Cleaned "10" for painting

3. Ran exp 356, 357 15" Tamped, untamped

4. Took off 15" put in 9"

5. Ran exp 358, 9" tamped

6.

1/5/50 1. Took out 9" put in 12"

2. Ran 12" Tamped

3. Ran 12" Untamped

4. Ran 12" + 4 shells $Bi_2O_2CO_3$ after filling large 2" shell with $Bi_2O_2CO_3$.

5. Ran preliminary slurry test

1/6/50 — Started slurry make-up

1/9/50 — Ran 4 Exp. including prep. of Bi slurry and filling shells with slurry as per Exp book.

1/10/50 — Dilution of present fuel and sampling - mixing in storage cylinders. calculation of Bi data, Polygraph test. prep for shipments of specs.

1/11/50 — 5 Exp - at new dilution - sampled new solution

1/12/50 — Filled $UO_2(NO_3)_2$ shell ran 2 Exp + Emptied shell.

1/13/50 — 3 Exp including sterilize still shell.

1/16/50 — finished Exp on 1/4 477 started packaging Normal for shipments. four cylinders to Y-12 for processing.

1/17/50 — Diluted to 7 x 800. Cleaned up Shop & Run 1

1/18/50 — Two Exp at new dilution sample taken to lab

1/20/50 Normal U. bottled up and barrels, Al shells and associated equipment sent to Cascade Services for decontamination. Pkg for Ser. # 2515

Two men from Cascade Services to clean up 9-18-15" reactor - also scrubbed floors for normal

Kanmich + Bartlow down for instruments Counters + #4 DC Amp..

Suggested Changes

1. Dump Valve on Seperate Circuit. Assume it to be Secondary Safety Circuit with Seperate Relay fed by a stable amplifiers so that spurious responses will not cause serious time loss,

Present Manual Scram Sw. to activate or deactivate all Safety circuits

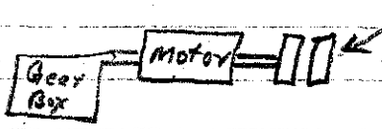
Control and Safety Rods can then be put in a fast circuit even if unstable since dropping a rod accidentally does not cause much lost time

2. All Rods held up by Solenoids in a common Safety Circuit.

Possible — use air-core DC coil.
or Use X-10 design.

3. Take Hi Voltage off Limit Switches and Control Buttons

4. Suitable Brake on Tamper Motor

Possible — 

5. Dump Pan Improved
possible - use Safe Pipe Size long
5" by 8 ft seems adequate
Vacuum return thru metering device. To storage

6. IMPROVE Dump Valve locate inside
of Dump Pipe
Possible - 1. Poppet valve with threads removed
Spring loaded to open - Bellows seal
Magnetic lock

2. Gate Valve with similar
opening + closing device

7. Control Rod Motor Operated similar to
tamper.

8. Rapid Lifting device for tamper incase
of Power Failure
1. Use of magnetic trigger to disengage
tampers + hoist tamper by counterweight.
note (this can also be part of Safety Circuit)

9. Use single fed control valve
with cyl valves only as on-off valves.
cyl valves could be solenoid operated.

10. Separate Cylinders for operation
and Transportation

1 Could draw off on operating cyl
could have sight glasses.
could have large calibrated cylinders built
for measuring.

✓ 11. P&B instrument controls + counter registers on task console.

✓ 12. Make source doghouse

✓ 13 Replace DC amp. with Reed instrometer

✓ 14. Sliding scales - for zeroing sightglass + control rods

15. Positive air release also in safety circuit with large line to valve (for rapid release) suggest magnetic release.

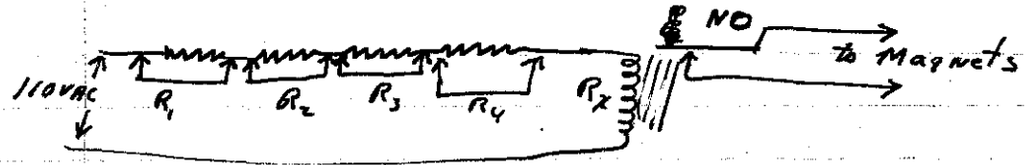
16. Isolation valve to isolate pressure system from feed system - operated from control room.

✓ 17. Deepen present water tank to increase amount of water beneath reactor.

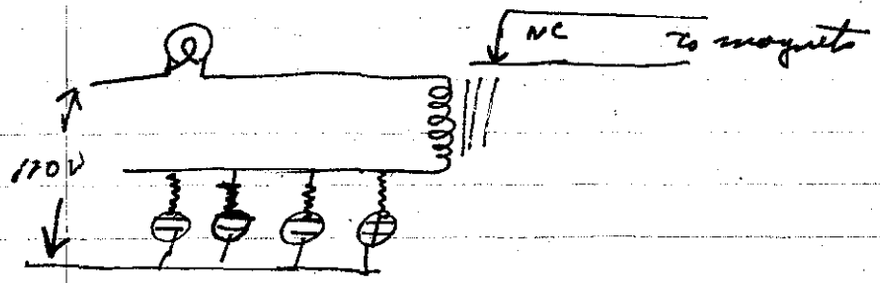
18. When ≥ 6 independent tripping circuits are used should be feasible to guard against accidental tripping by making it necessary for any two instruments to trip simultaneously before dump circuits are deenergized.
Instruments should include at least 2 fast response (Photo multiplier) 2 gamma chambers and 2 neutron chambers.
relays used should be vacuum contact relays to insure coincidence circuit operation avoid electronic tubes

PM
DHC

NO



R_1 ..... R_x = relays on instrument resistance adjusted so that if two or more are in series with R_x, R_x will drop out & R_x set to drop out at any 40% line volt.
1 resistance = reactance of R_x to ½ R_x see below *
or



any two Resistors will pass enough current to energize relay but 1 will only pass 75% of full current.

Existing instrument relays can be used in either of above circuits.

* It can be readily demonstrated that value of any resistance for series circuit should be $\frac{1}{\sqrt{2}} \times R_{or\ X}$ where R_x = impedance of relay

19. Flanged top for storage cylinders (for cleaning them) Holes in overage flange to fit studs for cylinder support & manifolds

20. Keep feasible inventory high enough so that the next solution to be used is stored already prepared & sampled. Changing solution would only be a matter of pumping out the old solution & pumping the new one in.

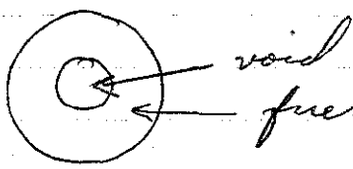
21. Weighed books (about 1 per year 150 pgs Harvard Coop type)
Reserve tabbed sections for each type of weighings
50 pgs for R (recovery) type - each # in order used.
50 pgs for H/X, inventory & samples (by cylinder letter & #) and 5 pgs or so for samples from Reactor (1 or 2 pages for each)
45 pgs for shipments (by cylinder #'s & letters - 2 or 3 pgs for each cyl)
5 pgs for record of unweighed combustible shipments to D.

JKF
Glen
SFC

[redacted]

Suggested Experiments

1. Insertion of A- a void B- a void with moderating material



Purpose - increase safe volume size for storage & operation.
NWD can be done with present equipment

2. Interaction between cyl in line ⊏ and not in line —

Also between large & small - 90° ellows to.

3. Measure temp coefficient for water - between 0° & 80°C at diff dilutions

4. further determination of infinite damping thickness.

5. Taking multiplication of a pure water core as 1.0 find multiplication of a normal uranium core (~0.9) & repeat with uranium solns having 235 isotopic assays of say 0.8 0.9 1.0 1.2 .... & determine for what assay "multiplication" becomes = one again. This is then lower limit below which there is no net neutron production & hence solns with lower assays than this cannot become critical

6. Use the limiting concentration in 5 above as a damper & thus separate the ~~capture~~ scattering (vc Neutron)

+ neutron production (or absorption) effects for normal uranium isotopes.

SECRET

SECRET